Chapter 2

Airport Development

2.1 Delay and the Need for Airport Development

Air traffic delay slipped temporarily from newspaper headlines, as a sluggish economy slowed growth in air transportation. The number of flights exceeding 15 minutes of delay has declined for the last three years, while commercial air carrier domestic passenger enplanements increased at an annual rate of less than 1 percent. However, air transportation has become a vital part of the United States economy. As the economic recovery gathers momentum, the demand for air travel will grow, and the number of aircraft operations will increase to meet that demand. Current forecasts indicate that, without capacity improvements, delays would increase substantially over the next decade, though at a somewhat slower pace than in the 1980s.

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The FAA's National Plan of Integrated Airport Systems (NPIAS) shows that, with the new improvements planned, capacity at the majority of the 29 "large hub" commercial service airports in the United States will be adequate to meet the forecast growth in demand. The few problem airports, which are predicted to continue to experience significant delay despite planned improvements, are primarily the large metropolitan area airports on the east and west coasts, principally in the Northeast and in California. At these problem airports, planned improvements are not adequate to meet the projected growth in demand, for a variety of reasons.

The positive message is that the capacity needed to meet future demand will be available at most of the Nation's busiest airports, if the improvements planned for these airports continue to be funded and built. It is, therefore, essential that the aviation community, in both the public and private sector, continues to work together to ensure that these improvement projects are completed in time to meet the growth in demand. However, the NPIAS points out that, even though capacity improvements are planned at the few delay-problem airports, they will not be enough to meet forecast demand at these airports. Delays there will most likely increase as demand increases.

The need for capacity improvement must continue to be emphasized so that projects will continue to be planned, funded, and built to keep pace with the projected demand.

From this perspective then, airport capacity improvements take on a two-tiered scheme of priorities. For most of the airports in the country, the need for capacity improvement must continue to be emphasized so that projects will continue to be planned, funded, and built to keep pace with the projected demand. This has been the work of the Airport Capacity Design Teams, which is described in more detail in this chapter.

For the few delay-problem airports, renewed emphasis must be given to finding innovative solutions, with a view toward developing regional airport systems to serve the expanding air transportation needs.

For the few delay-problem airports in the Northeast, in California, and elsewhere, renewed emphasis must be given to finding innovative solutions. New airports, expanded use of existing commercial-service airports, civilian development of former military bases, and joint civilian and military use of existing military facilities—these options and more must be explored systematically with a view toward developing regional airport systems to serve the expanding air transportation needs of these large metropolitan areas.

An FAA report to Congress, *Long-Term Availability of Adequate Airport System Capacity* (DOT/FAA/PP-92-4, June 1992), describes the probable extent of airport congestion in the future, given current trends. The three assessment techniques used in the study all point to a persistent shortfall in capacity at some of the busiest airports in the country as airport development lags behind the growing demand for air travel. The report acknowledges that some of the shortfall may be corrected by such things as improvements in technology and demand management. However, a significant gap in airport capacity will probably remain, and a major increase in the rate of airport development may be needed, together with measures to maximize the efficient use of existing capacity, and, in the longer term, to supplement air transportation with high-speed ground transportation. High-speed ground transportation will be discussed further in Chapter 6, Marketplace Solutions. Development of new airports and options to maximize the efficiency of existing airports will be discussed in this and subsequent chapters.

2.2 New Airport Development

The largest aviation system capacity gains result from the construction of new airports.

The largest aviation system capacity gains result from the construction of new airports. The new Denver International Airport, for example, will increase capacity and reduce delays not only in the Denver area but also throughout the aviation system. However, at a cost of over $2.9 billion for a new airport like Denver, it will remain a challenge to finance and build others. In addition, the development of new airports faces environmental, social, and political constraints. Scheduled to be operational in 1995, Denver International Airport is the only major new airport currently under construction. Bergstrom AFB is currently the only major military airfield being converted for civilian use, designed to replace Austin Robert Mueller Airport. Table 2-1 summarizes other major new airports that have been considered in various planning studies by state and local government organizations.

Table 2-1 Major New Airports — Under Construction and Planning Studies

Airport	Purpose	Status
New Denver	Replacement airport for Denver Stapleton (DEN), which will close.	Under construction. Scheduled to be operational in 1995.
Dallas-Ft. Worth	Supplemental airport.	Phase 2 satellite study by North Central Texas Council of Governments.
Minneapolis-St. Paul	Replacement airport for MSP. Proposal is to close existing airport.	Dual track. Feasibility study for new airport. Capacity enhancement study for existing airport completed.
West Virginia	Regional Airport.	Feasibility study underway.
Chicago	Supplemental airport.	Master Plan/EA in progress on State of Illinois preferred alternative (Peotone). Estimated completion 1/96.
Seattle-Tacoma	Supplemental airport.	Feasability study underway by Puget Sound Regional Council.
Boston	No active plans for a new airport. Emphasis on greater use of existing outlying airports.	Based on new studies, MASPORT decided not to landbank a new airport.
Atlanta	Supplemental airport.	Satellite study by Atlanta Regional Commission of non-ranked sites completed. Feasibility study by State of Georgia underway.
Northwest Arkansas	Replacement airport for Fayetteville (FYV), which will remain in operation.	Site selection/AMP/EIS completed. Feasibility study completed. Record of Decision signed 8/16/94.
Birmingham, Alabama	Replacement airport. Proposal is to close existing airport.	Site selection completed. Ranked sites and preferred sites identified by State of Alabama.
North Carolina	Cargo/industrial airport.	An existing airport, Kinston, N.C., was selected as the prefered site. EIS process underway.
Eastern Virginia	Supplemental airport.	Regional study by three Councils of Governments.
Louisiana	Intermodal facility. Replacement airport for MSY and Baton Rouge (BTR). Existing airports will remain in operation.	New airport feasibility study by State of Louisiana. Phase 2 site selection study has been completed.
Austin	Replace Robert Mueller Airport.	Conversion of Bergstrom AFB to civil use. AIP Grant issued FY94 for demolition of existing structures for new airport.
Phoenix	Regional airport.	Feasibility study underway for Phoenix/Tucson regional airport.
St. Louis	Replacement airport on existing site.	Master Plan Update and EIS underway.
San Diego	Supplemental or replacement airport.	A series of studies indicated that a new airport is needed, but a site has not been selected yet.

2.3 Development of Existing Airports — Airport Capacity Design Teams

As environmental, financial, and other constraints continue to restrict the development of new airport facilities, an increased emphasis has been placed on the redevelopment and expansion of existing airport facilities.

As environmental, financial, and other constraints continue to restrict the development of new airport facilities in the United States, an increased emphasis has been placed on the redevelopment and expansion of existing airport facilities. In 1985, the FAA initiated a renewed program of Airport Capacity Design Teams at airports across the country affected by delay. Airport operators, airlines, and other aviation industry representatives work together with FAA representatives to identify and analyze capacity problems at each airport and recommend improvements that have the potential for reducing or eliminating delay. The FAA Technical Center's Aviation Capacity Branch (ACD-130), which has been involved in airport capacity simulation modeling since 1978, provides a ready source of technical expertise.

Aircraft flight delays are generally attributable to one or more conditions, which include weather, traffic volume, restricted runway capability, and NAS equipment limitations. Each of these factors can affect individual airports to varying degrees, but much delay could be eliminated if the specific causes of delay were identified and resources applied to develop the necessary improvements to remove or reduce the deficiency.

Since the renewal of the program in 1985, 34 Airport Capacity Design Team studies have been completed. Currently, three Capacity Team studies are in progress. Table 2-2 provides the status of the program at the airports with Airport Capacity Design Teams, and Figure 2-1 shows the location of each of these airports.

Table 2-2. Status of Airport Capacity Design Teams

Airport Capacity Design Team Status			
Completed			Ongoing
Atlanta	Orlando	Albuquerque	Portland
Boston	Philadelphia	Ft. Lauderdale	Seattle-Tacoma Update
Charlotte/Douglas	Phoenix	Indianapolis	Atlanta Update
Chicago	Pittsburgh	Houston Intercont.	
Detroit	Raleigh-Durham	Minneapolis-St. Paul	
Honolulu	Salt Lake City	Port Columbus	
Kansas City	San Antonio	Washington-Dulles	
Los Angeles	San Francisco	Oakland	
Memphis	San Jose	St. Louis	
Miami	San Juan, P.R.	New Orleans	
Nashville	Seattle-Tacoma	Eastern Virginia	
Cleveland	Las Vegas	Dallas/Ft. Worth	

As of 10-01-94

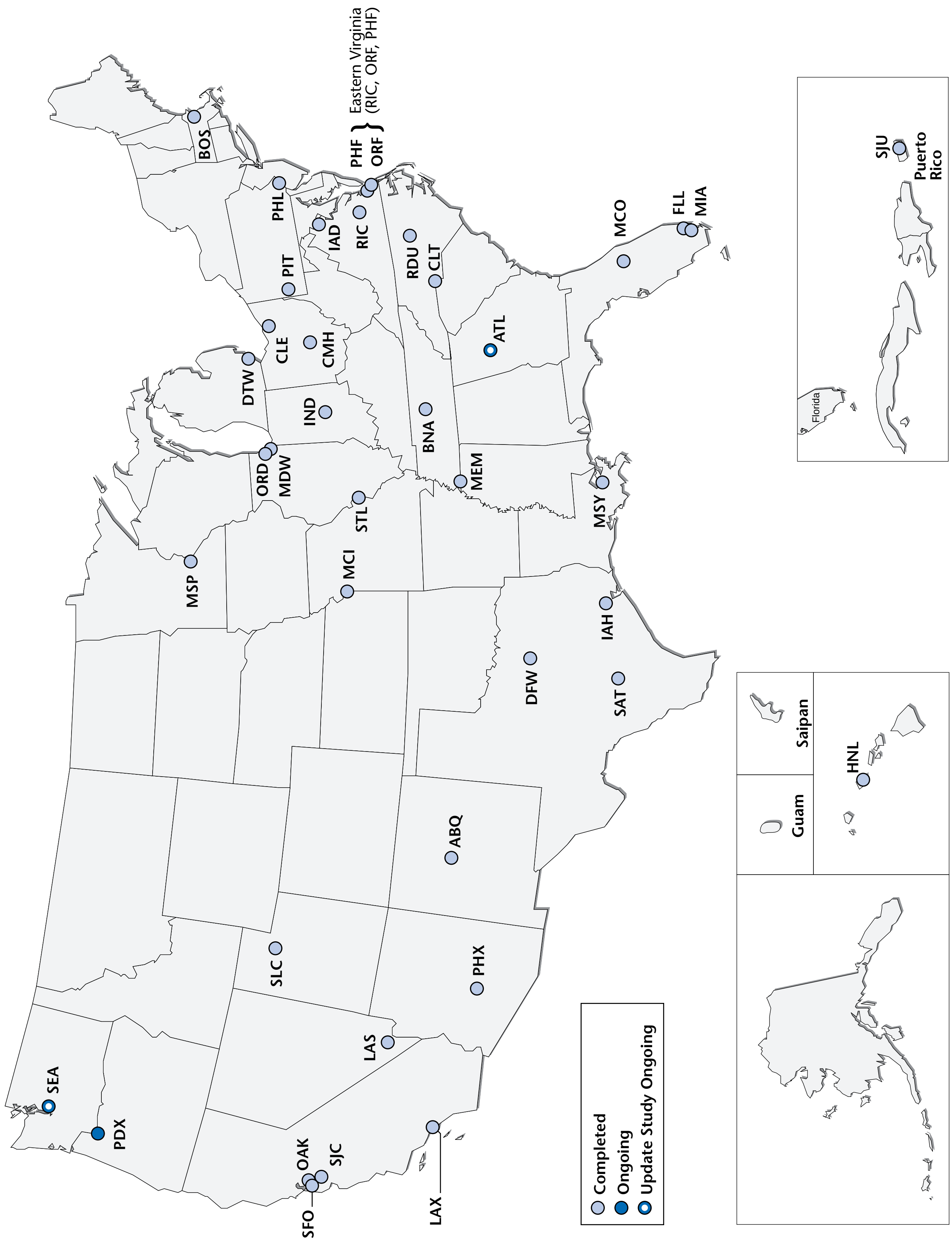

Figure 2-1. Airport Capacity Design Teams in the United States

2.3.1 Airport Capacity Design Teams — Recommended Improvements

Airport Capacity Design Teams identify and assess various corrective actions that, if implemented, will increase capacity, improve operational efficiency and reduce delay at the airports under study. These changes may include improvements to the airfield (runways, taxiways, etc.), facilities and equipment (navigational and guidance aids), and operational procedures. The Capacity Teams evaluate each alternative to determine its technical merits. Environmental, socioeconomic, and political issues are not evaluated here but in the master planning process. Alternatives are examined with the assistance of computer simulations provided by the FAA Technical Center at Atlantic City, New Jersey. In their final report, the Capacity Team recommends certain proposed projects for implementation. However, it should be noted that the presence of a recommended improvement in a Capacity Team report does not obligate the FAA to provide Facilities and Equipment (F&E) or Airport Improvement Program (AIP) funds. Demands for F&E and AIP funds exceed the FAA's limited resources and individual Capacity Team recommended projects must compete with all other projects for these limited funds.

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Airport Capacity Design Teams have developed more than 500 recommendations to increase airport capacity.

Table 2-3 summarizes these recommendations according to generalized categories of improvements. The Design Teams have developed more than 500 recommendations to increase airport capacity. Proposals to build a third or a fourth parallel runway were recommended by Design Teams at fourteen airports, proposals to build both a third and a fourth parallel runway were recommended at seven airports, proposals to build a new runway and a new taxiway were recommended at seven airports, proposals to build a new taxiway only were recommended at eleven airports, and proposals to build a new taxiway and new third and fourth parallel runways were recommended at five airports. Over half the capacity team reports have recommended proposed runway extensions, taxiway extensions, angled/improved exits, or holding pads/improved staging areas.

The only proposed facilities and equipment improvement that was recommended in more than half of the airport studies was the installation or upgrade of Instrument Landing Systems (ILSs) at one or more runways or runway ends, in order to improve runway capacity during IFR operations.

The proposed operational improvements that were recommended in half or more of the studies include improved IFR approach procedures and reduced separation standards for arrivals. One-third of the studies recommended an airspace analysis or restructuring of the airspace. Enhancement of the reliever and general aviation (GA) airport system was recommended at more than half of the airports.

Capacity Team recommendations demonstrate the FAA's efforts to increase aviation system capacity by making the most use of current airports.

In general, the Capacity Team recommendations demonstrate the FAA's efforts to increase aviation system capacity by making the most use of current airports. In the view of the Airport Capacity Design Teams, the "choke point" most often is found in the runway/taxiway system. Where possible, the construction of a third and even a fourth parallel runway has been proposed. Runway and taxiway extensions, new taxiways, and improved exits and staging areas have been recommended to reduce runway occupancy times and increase the efficiency of the existing runways. In addition to maximizing use of airport land, airports are making the best use of facilities, equipment, and procedures to increase arrival capacity during IFR operations. Equipment is being installed to accommodate arrivals under lower ceiling and visibility minima, including ILSs, RVRs, and improved radar, not to mention new and improved arrival procedures and reduced separation standards for arrivals, both in-trail and laterally. Finally, in an effort to segregate larger jets from smaller/slower aircraft, the FAA is recommending enhancement of the reliever and general aviation airport system.

2.3.2 Airport Capacity Design Teams — Potential Savings Benefits

The typical Capacity Team will make 20 to 30 recommendations for improvements to reduce delay at each airport. In many cases, the recommended improvements to the airfield represent the biggest capacity gains, particularly since they frequently incorporate the benefits of improved procedures and upgraded navigational equipment.

As can be seen from the summary of Capacity Team recommendations in Table 2-3, the typical Capacity Team will make 20 to 30 recommendations for improvements to reduce delay at each airport. Because of the large number of specific improvements, it is virtually impossible to summarize the expected benefits of each of these recommendations for all the airports. In many cases, however, the recommended improvements to the airfield represent the biggest capacity gains, particularly since they frequently incorporate the benefits of improved procedures and upgraded navigational equipment. Detailed information on specific delay-savings benefits can be found in the final reports of the various Airport Capacity Design Teams.

Table 2-4 provides examples of the potential delay savings benefits of the airfield improvements recommended by the Capacity Teams. These savings benefits were drawn from the final reports of selected Airport Capacity Design Team studies. Delay savings are stated in millions of dollars and thousands of hours of delay saved at the highest future demand level considered by the Capacity Team. A breakdown of the summarized material and additional information is contained in Appendix F of this report.

Table 2-3. Summary of Capacity Design Team Recommendations

Airports / Recommended Improvements	Airfield Improvements	Construct third parallel runway	Construct fourth parallel runway	Relocate runway	Construct new taxiway	Runway extension	Taxiway extension	Angled exits/improved exits	Holding pads/improved staging areas	Terminal expansion	Facilities and Equipment Improvements	Install/upgrade ILSs	Install/upgrade RVRs	Install/upgrade lighting system	Install/upgrade VOR	Upgrade terminal approach radar	Install	Install PRM	New air traffic control tower	Wake vortex advisory system	Operational Improvements	Airspace restructure/analysis	Improve IFR approach procedures	Improve departure sequencing	Reduced separations between arrivals	Intersecting operations with wet runways	Expand TRACON/Establish TCA	Segregate traffic	De-peak airline schedules	Enhance reliever and GA airport system
Richmond						√		√				√	√	√									√		√					
Norfolk						√						√	√	√											√					
Newport News						√		√															√		√					
Washington-Dulles		√			√	√	√		√	√			√	√									√		√				√	√
Seattle-Tacoma		√						√				√								√			√		√				√	
San Juan, Puerto Rico					√		√	√	√	√				√	√				√	√					√					√
San Jose						√		√	√															√						
San Fransisco		√	√			√	√	√	√															√					√	√
San Antonio		√			√	√	√		√			√	√	√				√		√		√	√		√					√
Salt Lake City		√					√	√	√	√		√	√	√			√	√					√		√					√
St. Louis		√					√	√	√			√		√			√			√			√		√				√	
Raleigh-Durham		√	√	√	√			√	√			√	√				√			√		√	√		√		√			
Pittsburgh			√			√				√		√						√				√								
Phoenix		√			√		√	√	√	√		√		√	√								√	√	√			√	√	√
Philadelphia		√		√		√												√				√	√	√						
Orlando			√		√		√		√			√			√		√	√				√	√					√		√
Oakland					√			√	√																					
New Orleans					√										√				√			√	√		√					√
Nashville			√	√	√	√	√		√			√								√		√	√				√		√	√
Minneapolis-Saint Paul		√	√		√	√		√	√	√		√	√	√	√			√				√			√					√
Miami					√		√	√	√			√	√	√			√						√							√
Memphis		√			√	√	√	√				√											√		√				√	
Los Angeles					√	√	√		√	√		√							√			√								
Kansas City		√	√				√	√	√	√		√	√				√						√		√				√	
Indianapolis		√	√	√	√			√	√			√	√	√			√						√		√					√
Houston Intercontinental		√	√		√	√		√	√	√		√											√						√	√
Honolulu		√				√		√	√	√		√																	√	√
Fort Lauderdale					√	√		√	√	√		√			√	√		√		√		√	√		√				√	√
Port Columbus		√	√	√	√	√		√	√	√		√		√			√	√	√			√	√		√				√	√
Cleveland		√		√	√	√	√	√		√		√			√			√					√	√	√					√
Chicago O'Hare				√	√	√		√	√			√											√			√				
Chicago Midway					√	√			√														√		√					
Charlotte-Douglas		√				√	√	√	√			√		√			√	√								√	√			√
Boston					√	√	√	√	√			√								√			√			√				
Atlanta					√			√	√	√		√	√	√		√	√			√					√				√	
Albuquerque					√	√	√	√	√	√		√			√								√		√					√

Table 2-4. Potential Savings Benefits from Airfield Improvements Recommended by Airport Capacity Design Teams

Airport Design Team	Major Recommended Improvements	Demand		Future 2 Savings	
		Baseline	Future 2	Hours	Dollars (M)
Fort Lauderdale-Hollywood	Extend runway and improve exits.	219,000	350,000	20,804	$32.5
Honolulu	Extend existing runway, construct new parallel runway, and improve exits.	407,000	700,000	457,730	$891.2
Houston Intercontinental	Extend existing runway, construct new third and fourth parallel runways, and improve taxiway and exit system.	334,000	650,000	1,267,000	$2,221.1
Los Angeles	Construct departure pads, construct new terminals and gates, and improve exits and taxiways.	641,751	782,056	69,451	$145.8
Minneapolis-Saint Paul	Construct new runway, construct third parallel runway, and improve exits and taxiways.	420,390	600,000	62,675	$90.7
Nashville	Relocate runway, extend existing runways, construct new parallel runway, and improve taxiways.	266,000	534,000	23,424	$23.9
Philadelphia	Construct new commuter runway and relocate and extend existing runways.	410,000	565,000	154,624	$215.4
Greater Pittsburgh	Build third and fourth parallel runways.	471,000	618,000	126,000	$129.0

Note: The potential annual delay savings in hours and dollars shown in the table represent the sum of the estimated savings benefits of the major recommended airfield improvements for each airport's Baseline and Future 2 demand levels. However, the savings benefits of these individual alternatives are not necessarily additive. They have been totaled here only to give an approximation on a single page of the impact these improvements could have in reducing delay at these airports.

It should also be noted that the particular combination of computer models and analytic methods used to calculate the annual delay costs and benefits is unique to each airport. Therefore, it is difficult, if not impossible, to compare one airport to another.

See Appendix F for a more detailed breakdown of the material summarized in this table.

2.4 Construction of New Runways and Runway Extensions

The construction of new runways and extension of existing runways are the most direct and significant actions that can be taken to improve capacity at existing airports. Large capacity increases, under both visual flight rules (VFR) and instrument flight rules (IFR), come from the addition of new runways that are properly placed to allow additional independent arrival/departure streams. The resulting increase in capacity is from 33 percent to 100 percent (depending on whether the baseline airport has a single, dual, or triple runway configuration).

Sixty of the top 100 airports have proposed new runways or runway extensions to increase airport capacity.[1] Fifteen of the 23 airports exceeding 20,000 hours of air carrier flight delay in 1993[2] are in the process of constructing or planning the construction of new runways or extensions of existing runways. Of the 32 airports that are forecast to exceed 20,000 hours of annual air carrier delay in 2003, if no further improvements are made, 24 propose to build new runways or runway extensions.[3]

Figure 2-2 shows which of the top 100 airports are planning new runways or runway extensions. Figure 2-3 shows which of the airports forecast to exceed 20,000 hours of annual delay in 2003 are planning new runways or runway extensions. Table 2-5 summarizes new runways and runway extensions that are planned or proposed at the top 100 airports. The "generic" hourly IFR capacities included in Table 2–5 have been developed only to provide a common basis for comparing one airport configuration to another. They serve to illustrate the size of the capacity increases provided. These generic estimates should not be taken as the exact capacity of a particular airport. The total anticipated cost of completing these new runways and runway extensions exceeds $9.0 billion.

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1. Airports with runway projects are pictured in Figures 2-2 and 2-3 and summarized in Table 2-5, with the projected IFR capacity benefit, the estimated project cost (to the nearest million), and an estimated operational date. The single figure of IFR capacity benefit does not reflect all of the many significant capacity benefits resulting from this new construction, but it does provide a common benchmark for comparison.
2. At a cost of $1,600 in airline operating expenses per hour of airport delay, 20,000 hours of flight delay translates into $32 million per year.
3. As reflected in Figure 2-3.

In 1992, Colorado Springs completed construction of a new 13,500 foot parallel runway, and Nashville and Washington Dulles completed runway extensions. In 1993, Detroit Metropolitan Wayne County completed construction of a new 8,500 foot parallel runway, and runway extensions were completed at Dallas-Fort Worth, San Jose, Kailua-Kono Keahole, and Islip Long Island Mac Arthur. In 1993, Salt Lake City and Memphis began construction of independent parallel runways, and Louisville Standiford Field began construction of two independent parallel runways. In 1994, Jacksonville opened the first 6,000 feet of a new parallel runway, and Kansas City completed construction of a new 9,500 foot independent parallel runway.

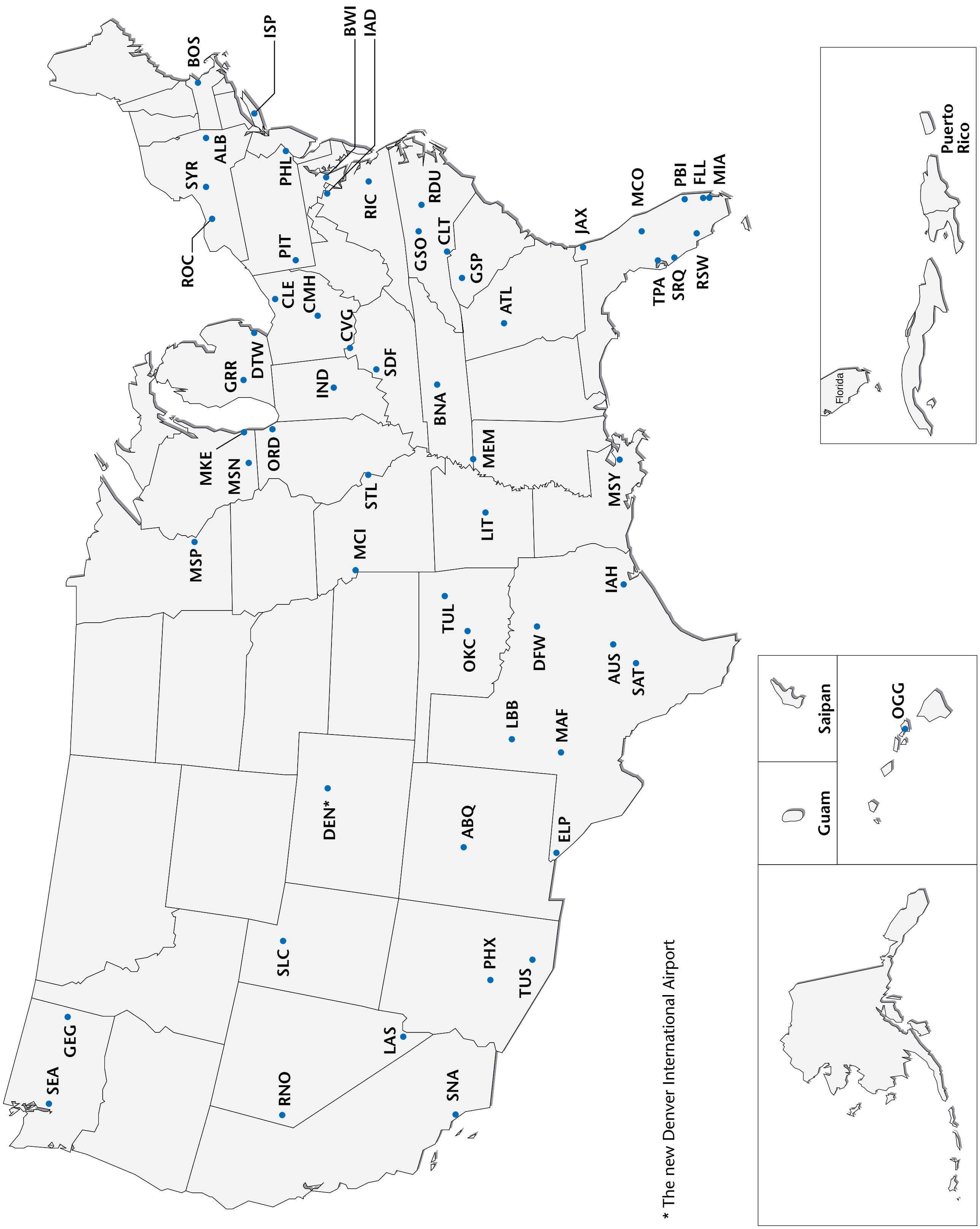

Figure 2-2. New Runways or Runway Extensions Planned or Proposed Among the Top 100 Airports

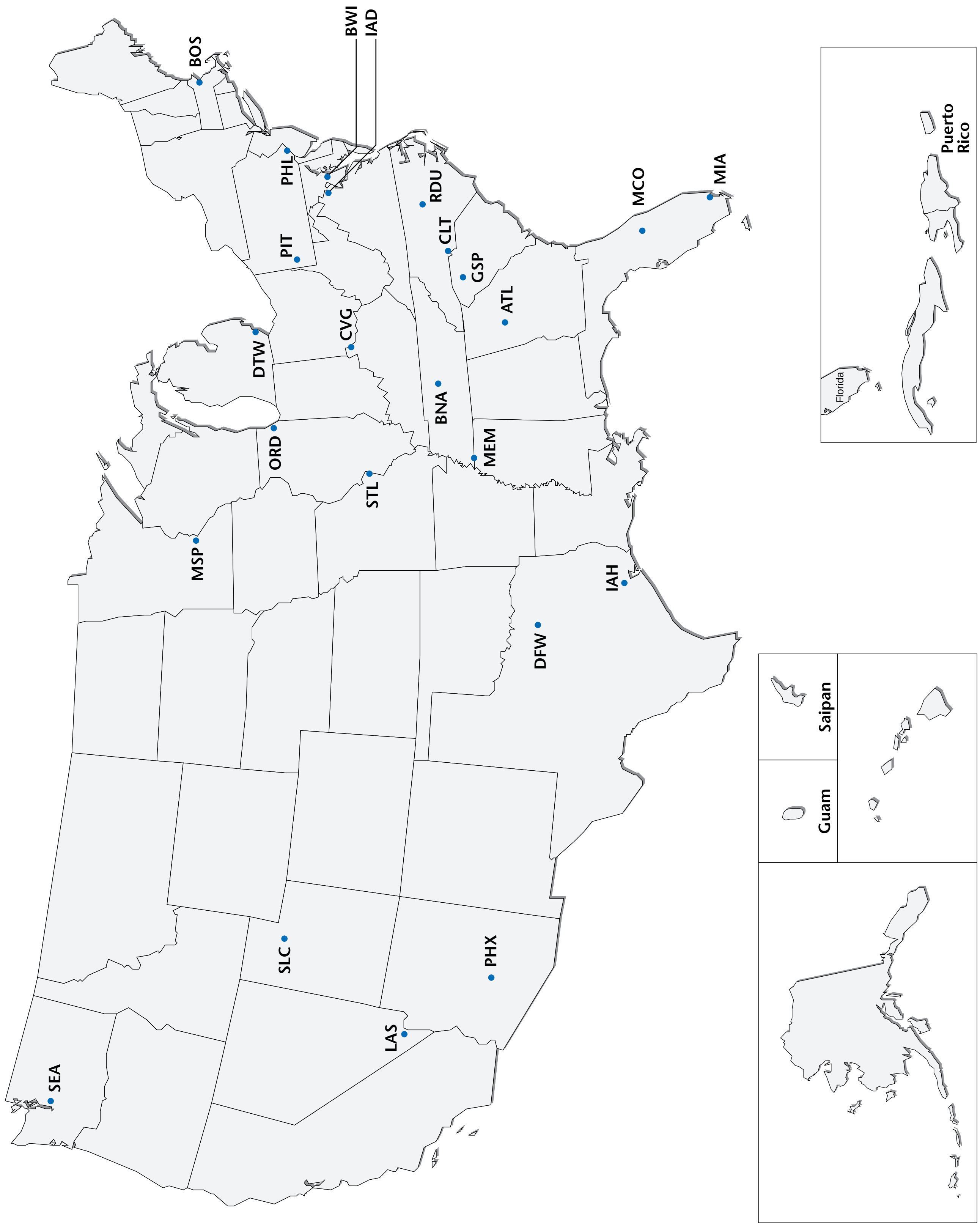

Figure 2-3. New Runways or Extensions Planned/Proposed Among the Airports Forecast to Exceed 20,000 Hours of Annual Aircraft Delay in 2003

Table 2-5. New and Extended Runways Planned or Proposed[+]

Airport	Runway	IFR Capacity (ARR/HR)[†] New Config.	Current Best	Est. Cost ($M)	Est. Date Oper.
Albany (ALB)	10/28 extension	29[2]	29[2]	$5.8	2005
	1R/19L parallel	++	29[2]	$7.5	2010
Albuquerque (ABQ)	3/21 extension	29[2]	29[2]	$20.0	1996
Atlanta (ATL)	E/W parallel	86[3]	57[1]	$160.0	1999
Austin (BSM) (new airport)	(Bergstrom AFB)	57[1]		$583.0	1998
Baltimore (BWI)	10R/28L parallel	57[11]	29[2]	$48.0	1996
	10/28 extension	29[2]	29[2]	$12.0	2003
Boston (BOS)	14/32	57[11]	29[2]	$5.0	1999
Charlotte (CLT)	18W/36W parallel	86[3]	57[1, 8]	$43.0	1999
	18E/36E parallel	114[10]	57[1, 8]		
Chicago O'Hare (ORD)	9/27 parallel	86[3]	57[1]		
	14/32 parallel	86[3]	57[1]		
	14L extension	57[1]	57[1]		
Cincinnati (CVG)	18R/36L extension	57[1,8]	57[1]	$11.0	1997
	9/27 extension	57[1,8]	57[1]	$25.0	1995
Cleveland-Hopkins (CLE)	5L/23R extension	29[2]	29[2]	$50.0	1999
	5W/23W parallel	42[4]	29[2]	$125.0	2000
Port Columbus (CMH)	10L/28R extension	42[4]	42[4]	$21.2	1998
	10S/28S parallel	57[11]	42[4]	$108.1	
	10N/28N parallel	57[1]	42[4]	$49.4	
Dallas-Fort Worth (DFW)	17R/35L extension	57[1]	57[1,7]	$20.0	1993
	18L/36R extension	57[1]	57[1,7]	$25.0	1997
	18R/36L extension	57[1]	57[1,7]	$24.0	1997
	16E/34E	86[3]	57[1,7]	$320.0	1996
	16W/34W	114[10]	57[1,7]	$150.0	2001
Denver (DEN)	New airport	86[3]	57[1]	$2,972.0	1995
Detroit (DTW)	4/22 parallel	71[6]	57[1]	$54.5	1998
El Paso (ELP)	8/26 parallel	++	29[2]	$10.7	
Fort Lauderdale (FLL)	9R/27L extension	42[4]	42[4]	$270.0	2000
Fort Myers (RSW)	6/24 extension	29[2]	29[2]	$20.0	1994
	6R/24L parallel	57[1]	29[2]	$87.0	2000

Table 2-5. New and Extended Runways Planned or Proposed[+]

Airport	Runway	IFR Capacity (ARR/HR)[†] New Config.	IFR Capacity (ARR/HR)[†] Current Best	Est. Cost ($M)	Est. Date Oper.
Grand Rapids (GRR)	8L/26R extension	29[2]	29[2]	$3.6	1994
	17/35 replacement	29[2]	29[2]	$40.0	1998
	8L/26R parallel	57[1]	29[2]		
Greensboro (GSO)	5L/23R parallel	57[1]	29[2]		
	14/32 extension	29[2]	29[2]	15.7	1998
Greer (GSP)	3R/21L parallel	57[1]	29[2]	$50.0	2015
	3L/21R extension	29[2]	29[2]	$34.1	1999
Houston (IAH)	14R/32L extension	57[1]	57[1]	$8.0	1997
	8L/26R parallel	86[3]	57[1]	$44.0	1999
	9R/27L parallel	114[10]	57[1]	$44.0	2002
Indianapolis (IND)	5L/23R replacement	57[1]	42[4]	$37.5	1995
Islip (ISP)	15R/33L extension	29[2]	29[2]	$26.0	2000
Jacksonville (JAX)	7R/25L parallel	57[1]	29[2]	$37.0	2000
	7L/25R extension	29[2]	29[2]	$19.0	1994
Kahului (OGG)	2/20 extension	29[2]	29[2]		
Kansas City (MCI)	1R/19L parallel	57[1]	29[2]	$45.2	1994
	1L/19R extension	29[2]	29[2]	$7.0	
Las Vegas (LAS)	7R/25L extension	29[2]	29[2]	$3.2	1995
	1L/19R reconstruction	29[2]	29[2]		1997
Little Rock (LIT)	4L/22R extension	57[1]	57[1]	$30.0	1996
Louisville (SDF)	17L/35R parallel	29[2]	29[2]	$42.0	1995
	17R/35L parallel	57[1]	29[2]	$51.0	1997
Lubbock (LBB)	8/26 extension	29[2]	29[2]	$3.8	2000
Madison (MSN)	3/21 Replacement	29[8]	29[8]	$15.0	1998
Memphis (MEM)	18E/36E parallel	57[1]	42[4]	$88.8	1997
	18L/36R extension	42[4]	42[4]	$58.0	1999
Miami (MIA)	9N/27N parallel	++	57[1]	$170	1999
Midland (MAF)	10/28 extension	29[2]	29[2]	$5.0	2005
Milwaukee (MKE)	7R/25L parallel	57[7]	29[2]	$150.0	2003
Minneapolis (MSP)	4/22 extension	42[4]	42[4]	$12.5	1995
Nashville (BNA)	2E/20E parallel	++	57[1]		
	2R/20L extension	57[1]	57[1]	38.6	2000

Table 2-5. New and Extended Runways Planned or Proposed[+]

		IFR Capacity (ARR/HR)[†]		Est.	Est.
Airport	Runway	New Config.	Current Best	Cost ($M)	Date Oper.
New Orleans (MSY)	1L/19R parallel	57[1]	29[2]	$340.0	2000
	10/28 parallel	57[1]	29[2]	$460.0	2020
Oklahoma City (OKC)	17L/35R extension	57[1]	57[1]	$8.0	
	17R/35L extension	57[1]	57[1]	$8.0	2014
	17W/35W parallel	57[1]	57[1]	$13.0	2004
Orlando (MCO)	17L/35R 4th parallel	86[3]	57[1]	$115.0	2000
Palm Beach (PBI)	9L/27R extension	29[2]	29[2]	$4.8	
	13/31 extension	29[2]	29[2]	$1.0	1999
	9R/27L extension	29[2]	29[2]	$0.5	1999
Philadelphia (PHL)	8/26 parallel-commuter	57[1,9]	57[7]	$215.0	1997
Phoenix (PHX)	7/25 3rd parallel	57[1]	42[4]	$88.0	1995
	8L/26R extension	42[4]	42[4]	$7.0	
Pittsburgh (PIT)	10C/28C extension	57[1]	57[1]	$10.0	1995
	4th parallel 10/28	71[6]	57[1]	$150.0	2000
	5th parallel 10/28	++	57[1]		
Raleigh-Durham (RDU)	Relocate 5R/23L	57[1]	57[11]		
	5W/23W	++	57[11]		
	5E/23E	++	57[11]		
Reno (RNO)	16L/34R extension	29[2]	29[2]	$22.0	1994
Richmond (RIC)	16/34 extension	29[2]	29[2]	$12.0	1997
Rochester (ROC)	4R/22L parallel	++	29[2]	$10.0	2010
	4/22 extension	29[2]	29[2]	$4.0	2000
	10/28 extension	29[2]	29[2]	$3.2	2000
St. Louis (STL)	14R/32L	++	29[2]	$390.0	1998
Salt Lake City (SLC)	16/34 west parallel	57[1]	42[4]	$120.0	1996
San Antonio (SAT)	N/S parallel	++	29[2]	$300.0	2005
Santa Ana (SNA)	1L/19R extension	29[2]	29[2]		
Sarasota-Bradenton (SRQ)	14L/32R parallel	57[1]	29[2]	$9.0	1998
	14/32 extension	29[2]	29[2]	$4.3	1996
Seattle-Tacoma (SEA)	16W/34W parallel	42[4]	29[2]	$400.0	2001
Spokane (GEG)	3L/21R	57[1]	29[2]	$11.0	2001
Syracuse (SYR)	10L/28R	57[1]	29[2]	$46.0	2000

Table 2-5. New and Extended Runways Planned or Proposed+

Airport	Runway	IFR Capacity (ARR/HR)† New Config.	Current Best	Est. Cost ($M)	Est. Date Oper.
Tampa (TPA)	18R/36L 3rd parallel	71[6]	57[1]	$55.0	2000
	27 extension	57[1]	57[1]		
	18L extension	57[1]	57[1]		
Tucson (TUS)	11R/29L parallel	29[2]	29[2]	$30.0	2005
Tulsa (TUL)	18E/36E parallel	86[3]	57[1]	$115.0	2005
Washington (IAD)	1L/19R parallel	86[3]	57[1,7]	$60.0	2009
	12R/30L parallel	57[1]	57[1,7]	$80.0	2010
Total Available Estimated Costs of Construction:				**$9.3 Billion***	

+ See endnotes 1-11, below, which describe the IFR arrival capacity of the current and potential new configurations.

++ Information on runway location is unavailable or too tentative to determine IFR multiple approach benefit of this new construction project.

* Includes the total costs of the new Denver International Airport, $2,972 million.

† Estimates of generalized hourly IFR arrival capacity increases are included in Table 2–5. These values have been updated from those originally reported in a 1987 report. The new numbers reflect the approval of 2.5 (for wet runways inside 10 nm), 3, 4, 5, and 6 nm in-trail separations and 1.5 nm diagonal separation for dependent parallel arrivals. The updated IFR arrival capacity of any single runway that can be operated independently is 29 arrivals per hour (rounded up from 28.5); dependent parallel runways, 42 arrivals per hour; and independent parallels, 57 arrivals per hour (2 times a single runway, 28.5). Other configurations are multiples of the above. These values are provided to illustrate the approximate magnitude of the capacity increase provided. They should not be taken as the exact capacity of a particular airport, since site-specific conditions (e.g., varying aircraft fleet mixes) can result in differences from these estimates.

Endnotes

1. Independent parallel approaches [57 IFR arrivals per hour].
2. Single runway approaches [29 IFR arrivals per hour {rounded up from 28.5}].
3. Triple independent approaches (currently not authorized) [86 IFR arrivals per hour {rounded up from 85.5}].
4. Dependent parallel approaches [42 IFR arrivals per hour].
5. Triple approaches with parallel and converging pairs may permit more than 57 IFR arrivals if procedures are developed.
6. Triple parallel approaches with dependent and independent pairs (currently not authorized) [71 IFR arrivals per hour {This is a rough estimate, obtained by adding 42 & 29 as explained above}].
7. Converging IFR approaches to minima higher than Category (CAT) I ILS [57 IFR arrivals per hour].
8. Added capacity during noise abatement operations.
9. Independent parallel approaches with one short runway.
10. If independent quadruple approaches are approved [114 IFR arrivals per hour].
11. Independent parallel approaches with PRM (3,400 ft. to 4,300 ft.) [57 IFR arrivals per hour].

2.5 Airport Tactical Initiatives

The recommendations by Airport Capacity Design Teams have emphasized constructing new runways and taxiways, extending existing runways, installing enhanced facilities and equipment, and modifying operational procedures. These improvements are normally implemented through established, long-term procedures. The Office of System Capacity and Requirements (ASC) has recently initiated an effort to identify, evaluate, and implement capacity improvements that are achievable in the near term and will provide more immediate relief for chronic delay-problem airports. Tactical Initiative Teams, made up of representatives from airport operators, air carriers, other airport users, and aviation industry groups together with FAA representatives, are now being established at selected airports to assess near-term, tactical initiatives and guide them through implementation.

The Office of System Capacity and Requirements has recently initiated an effort to identify, evaluate, and implement capacity improvements that are achievable in the near term and will provide more immediate relief for chronic delay-problem airports.

The first of these Tactical Initiative Teams completed a study at Los Angeles International Airport with a final report issued in September 1993. The team evaluated the impact on the crossfield taxiway system of proposed new gates on the west side of Tom Bradley International Terminal immediately adjacent to the taxiway system. The study examined airport delays and their causes (with and without the expansion of the west side of the terminal) and evaluated the effect of adding additional crossfield taxiways to mitigate the delays caused by the expansion.

A study was recently initiated at New York's LaGuardia Airport to evaluate the impact of introducing the Boeing 777-200 folding-wing aircraft on airfield operations. In addition to evaluating the effects of the new aircraft on capacity and efficiency, the study will examine the effects on safety, operating minimums, air traffic control procedures, and airway facilities.

Tentative plans call for a study at Orlando International Airport to evaluate the effects of proposed crossfield taxiways on airfield operations and a second study at Los Angeles International Airport to assess the impact on airfield operations of proposed remote commuter aircraft aprons.

2.6 Terminal Airspace Studies

The Office of System Capacity and Requirements has been developing a program of airspace capacity design team studies of the terminal and en route airspace associated with delay-problem airports across the country.

When an Airport Capacity Design Team study is completed, an airport has a recommended plan of action to increase its capacity. This plan will do little good, however, if the airspace in the vicinity of the airport cannot handle the increase in traffic. For this reason, the Office of System Capacity and Requirements has been developing a program of airspace capacity design team studies of the terminal and en route airspace associated with delay-problem airports across the country. Generally, these studies are intended to follow Airport Capacity Design Team studies. The first of these Terminal Airspace Studies was recently completed at San Bernardino International Airport (the former Norton Air Force Base). This study evaluated the impact of introducing scheduled air carrier service at the recently opened San Bernardino International Airport on the surrounding airspace, particularly the interaction of operations there with existing operations at Ontario International Airport. Additional studies were recently initiated at Philadelphia International Airport, Salt Lake City International Airport, and Tampa International Airport and are tentatively planned at San Antonio International Airport.

2.7 Regional Capacity Design Teams

Regional Capacity Design Team studies will analyze all the major airports in a metropolitan or regional system and model them in the same terminal airspace environment.

Looking beyond the individual airport and its immediate airspace, the Office of System Capacity and Requirements is planning a series of Regional Capacity Design Team studies. These regional studies will analyze all the major airports in a metropolitan or regional system and model them in the same terminal airspace environment. This regional perspective will show how capacity-producing improvements at one airport will affect air traffic operations at the other airports, and within the associated airspace. The first of these regional studies is planned for the San Francisco Bay area.

2.8 Airport Capacity Design Team Updates

For some airports and a comprehensive new Airport Capacity Design Team study may be needed to bring the airport up to date.

The present Airport Capacity Design Team effort began in 1985. Many of the capacity-producing recommendations made by these Airport Capacity Design Teams have been implemented or are scheduled for completion, others may need to be reevaluated, and still others may no longer be appropriate. For some airports, particularly those with studies completed in the 1980's, conditions may have changed to a considerable extent, and a comprehensive new Airport Capacity Design Team study may be needed to bring the airport up to date. For other airports, changes in one or more of the conditions at the airport may only require a more limited update. An Airport Capacity Design Team Update is underway at Seattle-Tacoma International Airport to evaluate the impact on airport operations of a proposed new dependent runway and to examine the interaction of operations on the new runway with existing operations at Boeing Field/King County International Airport. A second update was recently initiated at Hartsfield Atlanta International Airport.